



PATENTS

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In re Application of: **James H. Wang, et al.**Serial No.: **Not Yet Assigned**Filed: **April 10, 2001**For: **Melt Processable Poly(Ethylene Oxide) Fibers**Art Unit: **1619**Examiner: **Bawa, R.****DECLARATION OF JAMES H. WANG, Ph.D. UNDER 37 C.F.R. §1.132**

Assistant Commissioner of Patents & Trademarks
Washington, DC 20231

Sir:

1. I am currently employed by Kimberly-Clark Worldwide, Inc., assignee of the above-identified application, as an associate research fellow working in the field of polymer chemistry.

2. A copy of my *curriculum vitae* is attached hereto.

3. It is my opinion that, based upon the comparative examples set forth herein below, and in Application Serial No. 09/001,525, the unmodified poly(ethylene oxide) monofilaments produced by U.S. Patent No. 4,097,652 issued to Hartigan, Jr. (hereafter "Hartigan") do not form fibers from unmodified polyethylene oxide with molecular weights of 350,000 g/mol or less.

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner of Patents and Trademarks, Washington, DC 20231, on May, 3 2001.


Jennifer R. Seng, Reg. No. 45,851

4. It is my opinion that the poly(ethylene oxide) homopolymer of Hartigan cannot form into fibers because it is unmodified poly(ethylene oxide) with a molecular weight of 400,000 to 900,000. The homopolymer of Hartigan does not have the melt strength or melt elasticity to form fibers directly from a melt process without stretching and quenching.

5. It is my opinion that modifying poly(ethylene oxide) with a polar vinyl monomer, as in the present application, improves the melt properties of poly(ethylene oxide) and allows for thermal processing of fibers made from modified poly(ethylene oxide).

6. I performed the following experiments which support the above statements.

Comparative Example A

A PEO resin having a molecular weight of about 200,000 g/mol was processed through the Haake extruder under similar conditions as the modified examples of the invention for comparative purposes and to demonstrate that conventional, unmodified PEO resins cannot be melt processed into fibers. The 200,000 g/mol molecular weight unmodified PEO resin that was used for this comparative example was obtained from Planet Polymer Technologies. The resin obtained from Planet Polymer Technologies was in pellet form and was compounded from POLYOX® WSR N-80 PEO resin manufactured by Union Carbide Corp.

For processing, the extruder barrel temperatures were set at 170, 180 and 180 °C for the first, second, third heating zones, respectively, and 190 °C for the die. The screw speed was set at 150 rpm. The PEO resin was fed into the extruder at a throughput of about 5 pounds per hour. No monomer or initiator was added to the PEO resin of Comparative Example A. The unmodified PEO was extruded under the above conditions, cooled in air and palletized for later use. Attempts were made to melt process the unmodified PEO of Comparative Example A into fibers. Because the melted PEO of

Comparative Example A had too low melt elasticity and too low melt strength to allow attenuation of the PEO melt, fibers could not be melt processed using conventional fiber-spinning techniques, such as Lurgi gun, starter gun and free fall. The PEO melt extruder from the spinning plate snapped easily and did not allow the unmodified PEO to be drawn into fibers. Only strands of about 1 to 2 millimeters in diameter were able to be produced from the unmodified PEO of Comparative A.

Comparative Example B

A PEO resin having a molecular weight of about 100,000 g/mol was processed through the Haake extruder under the same conditions as above Comparative Example A. The 100,000 g/mol molecular weight PEO resin that was used for this Comparative Example B was obtained from Planet Polymer Technologies was in pellet form and was compounded from POLYOX® WSR N-10 PEO resin manufactured by Union Carbide Corp. Attempts were also made to melt process the unmodified PEO of Comparative Example B into fibers. Fibers of diameters of less than about 100 micrometers could not be melt processed from the unmodified 100,000 g/mol molecular weight PEO resin using conventional fiber-spinning techniques. Even then the melt could only be drawn very slowly and the melt was easily broken, making commercial production of fibers from PEO impractical. Thus, The Comparative Examples A and B demonstrate that prior art, unmodified PEO resins cannot be melt processed into fibers.

7. I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statement may jeopardize the validity of the application or any patent issuing thereon.

Date: April 10, 2001



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EDUCATION

Ph.D.	Polymer Science	1991	Case Western Reserve University
M.S.	Cellulose Chemistry	1986	Virginia Tech
B.S.	Chemical Engineering	1982	Northeast Forestry University, China

EXPERIENCE

1996-Present	Associate Research Fellow Research and Development Kimberly-Clark Corporation, Neenah, Wisconsin.
1994-1995	Senior Research Scientist Research and Development Kimberly-Clark Corporation, Neenah, Wisconsin
1991-1993	Product Development Chemist Chevron Chemical Company, Orange, Texas.

PROFESSIONAL AFFILIATIONS

American Chemical Society
Society of Plastics Engineers

HONORS

National Scholarship for Graduate Studies (from China), 1984-1985.

Phi Kappa Phi Honor Society (for academic excellence), 1985.

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2. W. G. Glasser and J. H. Wang, "Derivatives of Lignin and Lignin-like Model Compounds with Acrylate Functionality", in *Lignin: Properties and Materials*, ACS Symposium Series 397, W. G. Glasser and S. Sarkanen, Eds., American Chemical Society, Washington, D. C., **1989**, p. 515.
3. V. Percec and J. H. Wang, "The Influence of Total Monomer Concentration and Polymerization Solvent on the Reactivity of ω -(*p*-Vinylbenzyl Ether) Macromonomers of Poly(2,6-Dimethyl-1,4-Phenylene Oxide)", *J. Polym. Sci., Polym. Chem. Ed.*, **28**, 1059(1990).
4. V. Percec, U. Epple, J. H. Wang, and H. A. Schneider, "The Influence of Total Monomer Concentration on the Reactivity of ω -(*p*-Vinylbenzyl) Macromonomers of Poly(2,6-Dimethyl-1,4-Phenylene Oxide) Determined from Radical Copolymerization Experiments with Butyl Methacrylate", *Polym. Bull.*, **23**, 19(1990).
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19. V. Percec and J. H. Wang, "Free Radical Copolymerization of ω -(*p*-Vinylbenzyl Ether) Macromonomer of Poly(2,6-Dimethyl-1,4-Phenylene Oxide) with Methyl Methacrylate in the Presence of Different Initiators", *J. Macromol. Sci., Macromol. Reports*, **A28**, Suppl. 3, 221(1991).
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22. V. Percec, J. H. Wang, and Y. Oishi, "Synthesis of Aromatic Polyethers by Scholl Reaction. VIII. On the Polymerizability of 1,5-Bis(Phenoxy)Pentanes and 1,5-Bis(Phenylthio)Pentane", *J. Polym. Sci., Part A: Polym. Chem.*, **30**, 439(1992).
23. V. Percec and J. H. Wang, "Synthesis of Aromatic Polyethers by Scholl Reaction. IX. Cation-Radical Polymerization of 4,4'-Bis(2-Naphthoxy)Diphenyl Sulfone", *J. Mater. Chem.*, **1**, 1051(1991).
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PRESENTATIONS

1. V. Percec, J. H. Wang, and S. Okita, "Synthesis of Soluble Polyarylenes and Polyarylene Ethers by Increasing Configurational Entropy of the Backbone," *Book of Abstracts, 203rd National Meeting of American Chemical Society, Division of Polymer Chemistry, Inc., #406, April 5-10, 1992, San Francisco, CA.*
2. V. Percec and J. H. Wang, "'Reactivity' of ω -(*p*-Vinylbenzyl Ether) Macromonomer of Poly(2,6-Dimethyl-1,4-Phenylene Oxide)," *Book of Abstracts, 201th National Meeting of American Chemical Society, Division of Polymer Chemistry, Inc., #314, April 14-19, 1991, Atlanta, GA.*

3. V. Percec and J. H. Wang, "Synthesis of Aromatic Polyethers by Cation-Radical Polymerization," *Book of Abstracts, 201th National Meeting of American Chemical Society*, Division of Polymer Chemistry, Inc., #242, April 14-19, 1991, Atlanta, GA.
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5. V. Percec and J. H. Wang, "Concentration and Solvent Effects on the 'Reactivity' of Macromonomers," *Book of Abstracts, 196th National Meeting of American Chemical Society*, Division of Polymer Chemistry, Inc., #96, September 25-30, 1988, Los Angeles, CA.
6. W. G. Glasser and J. H. Wang, "Derivatives of Lignin and Lignin-like Model Compounds with Acrylate Functionality," *Book of Abstracts, 195th National Meeting of American Chemical Society*, Division of Cellulose, Paper & Textile, #56, June 5-10, 1988, Toronto, Canada.

ResumeJHW 4/2001